

Are food losses and waste overestimated in developing countries?

Géraldine Chaboud¹

Introduction

In spite of the growing concern on food losses and waste (FLW) issues, empirical research on FLW along food supply chains (FSC) in developing countries, from production to retail, is uncommon (Minten *et al.*, 2016; Parfitt *et al.*, 2010). Details on how FLW have been calculated and where unsold food products actually end up are rarely available (*e.g.* garbage, home-consumption, food donation, feeding, etc.). However, the common belief stipulates that in developing countries, FLW are expected to be greater at post-harvest stages (harvest, storage, transport, retail) due to poor post-harvest handling and technical constraints (Godfray *et al.*, 2012; Hodges *et al.*, 2011).

This study presents some of the following advantages. First, the levels of FLW along the “traditional” tomato value chain that supplies the city of Cali in Colombia are assessed. Where knowledge gaps exist, data and empirical findings are generated and provided, respectively. Second, this case study is helpful for observing what happens to unsold tomatoes and where they actually end up. It is not unknown that informal waste recycling in those countries is common (Medina, 2008). Municipalities of developing countries often deal with environmental and sanitary problems caused by waste (Thi *et al.*, 2015). It is the case of Cali where the municipality launched in 2014 the program “Cero basura”[1] within “Cali Bioagradable”. Detailed information on the different destinations of unsold products is provided but only food products that ended up in the garbage were considered as FLW. FLW were approached from a waste management perspective. Third, the case study selected is used to verify (or not) the common belief about high post-harvest losses in developing countries, especially in semi-informal channels. Finally, with the perspective of improving the assessment and report of FLW, a methodological framework was designed and used as a guide to set up the survey questionnaire, as well as report empirical findings. It has helped us avoid assessment bias, as far as possible, and to ensure transparency when reporting data.

Methodology

The aim was to identify a representative sample for the whole “traditional” tomato value chain that supplies Cali and representatives of each type of stakeholder involved. Producers grow and sell their agricultural products; traders provide the link between the rural area and the city, while corners stores sell food products to urban consumers. Different interviews and surveys were carried out to understand the role of each actor and to assess the level of FLW at each stage (*i.e.* farmers, traders – wholesalers, middleman – and corner stores). Exploratory interviews with experts and stakeholders were conducted. Then surveys were conducted with three types of structured questionnaires adapted to each FSC stakeholder. We surveyed 99 farmers, 18 traders and 200 corners stores. FLW were, therefore, assessed on the basis of the FSC stakeholders’ declarations. We used a downstream survey approach from retailers to farmers in order to better target the farmers who supply tomatoes to the wholesale markets in Cali.

Results and discussion

During the crop cycle, on average 6.2% of the available tomatoes are left in the field by farmers and on average a producer throws away 9.2% of the tomatoes harvested. Beyond the farm gate, on average, 1.2% of the products purchased by a trader remain unsold and only 0.5% of the purchased products end

1. CIRAD, UMR MOISA, F-34398 Montpellier, France.

up in the garbage. Retailers purchase products, of which on average 4.3% remain unsold and only 1.7% is actually thrown away.

Data shows five main results:

- Transport losses are not significant along the tomato value chain.
- Farmers are the stakeholders in the FSC who most frequently report FLW.
- There are greater differences in FLW between farmers than at other stages. This suggests that there are discrepancies in the performance of farming operations (management practices and/or agro-climatic environment) and/or in terms of farmers' socio-economic characteristics, which could explain the scale of farmers' FLW.
- Farmers frequently declare FLW. However, only a few farmers report substantial FLW, which suggests that high rates of FLW tend to be concentrated. The pattern is similar for retailers. As Kaminski and Christiaensen (2014) claim that the relatively low incidence of FLW, together with the relatively high rates of FLW (incurred in our case among farmers and retailers), underlines the need for carefully targeted FLW operations.
- Unsold tomatoes or tomatoes considered unmarketable by stakeholders are frequently used for different purposes. Unsold products tend to have a second "life".

The information shared by FSC stakeholders in the surveys and interviews is coherent with the results on amounts of FLW, which confirms the general accurateness of the data collected.

The modes of transport used from rural areas to the city are not refrigerated, but delivery is relatively fast (from 1.5 to 2 hours on average). Farmers and traders mainly transport tomatoes by truck. They use food box package for protecting tomatoes during transport. Moreover, during the transport stage other measures are widespread among stakeholders to prevent FLW (*e.g.* heavier produce is put at the bottom, tomato box package are not overloaded, fast delivery, they load their own produce, etc.). Speedy delivery and preventive measures for minimising FLW, adopted by farmers and traders, can explain the absence of FLW during transport.

Farmers are the stakeholders in the FSC who most frequently report FLW. This first result is consistent with the stakeholders' perception of the frequency of FLW. A higher percentage of farmers (58%) consider that they have FLW all or most of the time in comparison to traders (22%) and retailers (25%). The farmers' perceptions and responses are coherent with the FLW levels recorded. Diseases and pests were identified by farmers as the major causes of agricultural losses and waste. Pre-harvest management of pests and diseases can partly explain the amounts of tomatoes not harvested and those harvested and not sold. Consistency was finally confirmed by production practices. In the area surveyed, more than half of the farmers grow tomatoes outside. Outdoor cultivation is more exposed to diseases, pests and climatic conditions than semi-greenhouse and greenhouse cultivation. The mode of production adopted by the majority of the farmers is likely to impact the quality and quantity of tomatoes produced.

The average rates of unsold products for traders and retailers are low. The data matches the traders' perception given that approximately three-quarters of traders declare that FLW levels are low or very low. Their responses suggest that tomatoes are easy to sell on the market irrespective of product quality. Traders also claim to have in-depth knowledge of the tomato market, as well as the different outlets depending on the quality of the product. Generally, tomatoes are delivered to wholesalers the afternoon before the market night. Subsequently, they resell the tomatoes the same night. The time of storage is short. Similarly to traders, retailers affirm that tomatoes are easy to sell. They claim that FLW are low because they buy small quantities of produce on a daily basis and the demand for tomatoes in the market is high. Most of the respondents (80%) store tomatoes for no more than 3 days. The traders and retailers' marketing and storage practices seem to explain the low average percentages of unsold products.

The average rate of FLW per trader and retailer are even lower. This is not surprising for several reasons. The informal sector plays an essential role when it comes to alternative uses for food products originally destined for sale. The interviews with wholesalers revealed that at the end of market day, it is not

uncommon to see housewives coming to the market to recover unsold products for cooking. People also recover food products for resale in the street. In Cavasa (the wholesale market), the Cali Food Bank also recovers unsold products at the end of each market. Other products unfit for sale are recycled at the composting plant located in Cavasa. This reduces the volume of food products that are thrown away. Over and above food donation, retailers and farmers use produce for home-consumption to avoid throwing away unmarketable tomatoes. On average, a retailer uses more tomatoes for home-consumption than a farmer. This is coherent for two reasons. Firstly, farmers manage larger volumes of tomatoes than retailers, *i.e.* home-consumption is expected to cover a smaller part of the total volume. Secondly, during the survey and interviews farmers shared their concerns about eating their own tomatoes because of the intensive use of pesticides and chemical fertilisers. Some of the farmers are reluctant to use their own tomatoes for home-consumption in order to avoid any health risks.

Conclusions

Insights from the case study selected are important to guide future areas of research and intervention policies.

Firstly, data show that FLW recorded at the harvest and post-harvest stages are likely to be linked to pre-harvest management. Therefore, depending on the target product, pre-harvest stages could constitute an important step for inclusion in future studies. At the empirical level, interventions, such as training, assistance and support for farmers at the pre-harvest management stage appear essential. They could help increase the efficiency of resource use by reducing the quantity of tomatoes likely to be discarded and by improving the quality of tomatoes sold along the entire FSC.

Secondly, the average rate of food products discarded is in itself not sufficient to justify the research interest and guide policy intervention. Data may conceal more important issues. The rates of tomatoes thrown away at the trader and retailer stages are low. Yet, that does not mean that attention and intervention are not required at these stages. The relatively low level of FLW raises questions about the safety and health risks of the tomatoes sold to consumers

(*e.g.* high level of pesticide residues) because of poor marketing control and a lack of standards. Stakeholders may also suffer losses with low quality produce by increasing their qualitative FLW. Stakeholders are paid little for poor quality tomatoes, which can cause economic losses.

Thirdly, in developing countries, FLW at post-harvest stages cannot always be explained by poor post-harvest handling, lack of infrastructure and technical constraints as suggested in the literature (Godfray *et al.*, 2012; Hodges *et al.*, 2011). Stakeholders adopt strategies to overcome technical constraints and limitations linked to infrastructure in order to minimise FLW at their own stage. In addition, coordination among stakeholders appears essential to minimise FLW at the meso-level of the FSC.

Finally, assessing the determinants that significantly influence FLW along the FSC is essential for future recommendations, the design and implementation of effective intervention policies. Here, the case study focuses on quantitative measurements. However, alternative estimates of FLW based on a qualitative view would complement the analysis and provide an integrative overview of FLW issues.

Bibliography

- Affognon H., Mutungi C., Sanginga P., Borgemeister C., 2015. Unpacking Postharvest Losses in Sub-Saharan Africa: A Meta-Analysis. *World Dev.* 66, 49–68. doi:10.1016/j.worlddev.2014.08.002
- Godfray H.C.J., Beddington J.R., Crute I.R., Haddad L., Lawrence D., Muir J.F., Pretty J., Robinson S., Thomas S.M., Toulmin C., 2012. The Challenge of Food Security. *Science* (80-.). 327, 812. doi:10.4337/9780857939388
- Hodges R.J., Buzby J.C., Bennett B., 2011. Postharvest losses and waste in developed and less developed countries: opportunities to improve resource use. *J. Agric. Sci.* 149, 37–45. doi:10.1017/S0021859610000936

Kaminski J., Christiaensen L., 2014. Post-harvest loss in sub-Saharan Africa-what do farmers say? *Glob. Food Sec.* 3, 149–158. doi:10.1016/j.gfs.2014.10.002

Medina M., 2008. The informal recycling sector in developing countries Organizing waste pickers to enhance their impact. *Gridlines Shar. Knowledge, Exp. Innov. public-private Partnersh. Infrastruct.* 4, 1–4. doi:10.1080/17535069.2011.579777

Minten B., Reardon T., Das Gupta S., Hu D., K.A.S M., 2016. Wastage in Food Value Chains in Developing Countries: Evidence from the Potato Sector in Asia. *Food Secur. a Food Abund. World.* doi:10.1108/S1574-871520150000016010

Parfitt J., Barthel M., Macnaughton S., 2010. Food waste within food supply chains: quantification and potential for change to 2050. *Philos. Trans. R. Soc. London – Ser. B Biol. Sci.* 365, 3065–3081.

Thi N.B.D., Kumar G., Lin C.-Y., 2015. An overview of food waste management in developing countries: Current status and future perspective. *J. Environ. Manage.* 157, 220–229. doi:10.1016/j.jenvman.2015.04.022

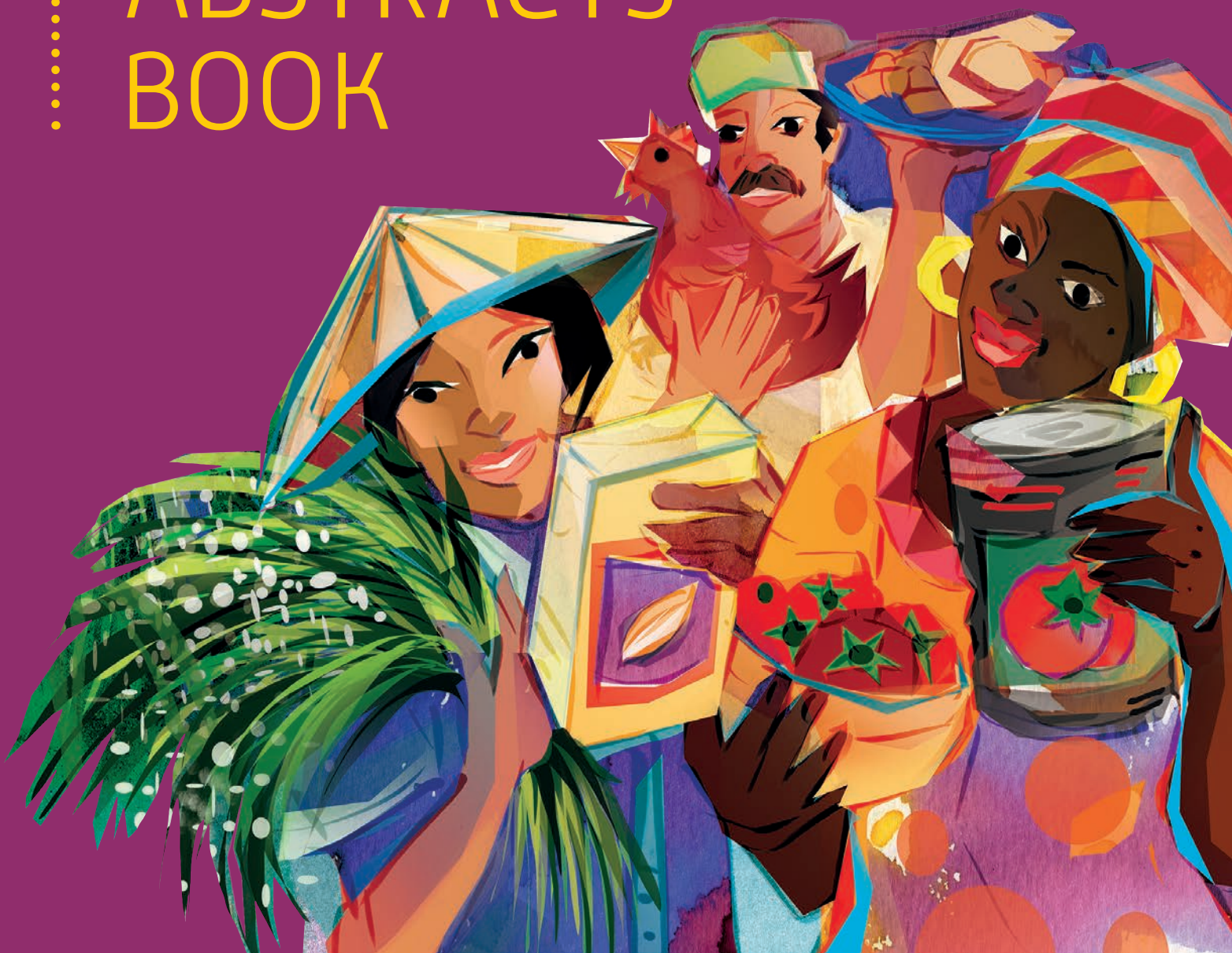
“Zero waste”

12-14 December 2016,
Le Corum, Montpellier - France



Agri-Chains & Sustainable Development
> *Linking local and global dynamics*

ABSTRACTS BOOK



WELCOME ADDRESS



Welcome to AC&SD 2016

On behalf of the Scientific and Organizing Committees, it is a great pleasure to welcome you to the International Conference on Agri-chains and Sustainable Development (AC&SD 2016). This conference aspires to widen the debate about the role of agricultural value chains towards sustainable development. Year 2015 was a critical political and diplomatic milestone: the member states of the United Nations signed a new agenda for development, with the 17 Sustainable Development Goals (SDGs) placing sustainability at the core of international efforts. Development and academic actors are since then exploring new avenues for translating the SDGs into reality and implementing global and local frameworks and partnerships. Our conference aims at joining these efforts, with the consideration that agricultural value chains form spaces where local and global challenges to sustainability connect and within which local and global actors experiment and negotiate innovative solutions.

The scientific committee has assembled a very attractive program for AC&SD 2016 that seeks to cover and confront the diversity of realities behind agri-chains, from localized chains, embedded in specific places, to global value chains. In the parallel sessions, transformations of these agri-chains and their connections to sustainable development will be discussed by speakers from the academia, the civil society, the private sector and decision makers. This multi-stakeholder perspective will also be brought about in the plenary sessions. Here, world renowned keynotes and panelists to three high level round tables will discuss about the role and importance of evaluation, public and private institutions and innovations at different scales for transforming agri-chains towards sustainability transitions.

This edition gathers about 250 participants from 39 countries. AC&SD 2016 owes a lot to the scientific and organizing committees for preparing the program, and particularly to Brigitte Cabantous, Chantal Carrasco and Nathalie Curiallet for all the logistics, as well as to our support team of Alpha Visa that we warmly thank for their help.

We wish us all a fascinating, successful, inspiring and enjoyable AC&SD 2016 and we very much look forward to its result and to the strengthening of both a scientific community and a community of practice to implement the outcome!!

Estelle Biénabe, Patrick Caron and Flavia Fabiano,
Cirad Co-chairs AC&SD 2016

COMMITTEES

Scientific committee

- **Estelle Bienabe**, CIRAD, France**
 - **Julio Berdegué**, RIMISP, Chile*
 - **Thierry Bonaudo**, AgroParisTech, France
 - **Larry Busch**, Michigan State University, USA
 - **Patrick Caron**, CIRAD, France*
 - **François Côte**, CIRAD, France
 - **Benoît Daviron**, CIRAD, France
 - **Djiby Dia**, ISRA, Senegal
 - **Flavia Fabiano**, CIRAD, France**
 - **Pierre Fabre**, European Commission EuropeAid, Belgium
 - **Bernard Hubert**, Agropolis International, France*
 - **Patrice Levang**, IRD, France
 - **Florence Palpacuer**, Université de Montpellier, France
 - **Felicity Proctor**, RIMISP, UK
 - **Ruerd Ruben**, Wageningen UR, The Netherlands
 - **Nadia Scialabba**, FAO, Italy
 - **Dao The Anh**, CASRAD, Vietnam
 - **Alban Thomas**, INRA, France*
 - **Jodie Thorpe**, IDS, UK*
 - **Sophie Thoyer**, Montpellier SupAgro, France
 - **Maximo Torero**, IFPRI, USA
- * Member of the international organising committee
** Member of the local organising committee

Organising committees

International organising committee

- **Karen Brooks**, IFPRI, USA
- **Jean-Marc Chataigner**, IRD, France
- **Clement Chenost**, Moringa Fund, France
- **Thierry Doré**, AgroParisTech, France
- **Ronan Le Velly**, Montpellier SupAgro, France
- **Huub Loffler**, Wageningen UR, The Netherlands
- **Philippe Pipraud**, French Ministry of Agriculture, France
- **Lilian Puech**, French Ministry of Foreign Affairs, France

Local organising committee

- **Frédéric Bourg**, CIRAD, France
- **Brigitte Cabantous**, CIRAD, France
- **Chantal Carrasco**, CIRAD, France
- **Nathalie Curiallet**, CIRAD, France
- **Frédérique Causse**, CIRAD, France
- **Delphine Guard-Lavastre**, CIRAD, France
- **Nathalie Villeméjeanne**, Agropolis International, France

Landscape factors influencing sustainable food agri-chain innovation: The role of place in the Toronto experience of Local Food Plus	173
<i>Wayne Roberts [et al.]</i>	
Are food losses and waste overestimated in developing countries?	176
<i>Géraldine Chaboud</i>	
Vulnerability and resilience of the urban food system to extreme weather: a case study of Colombo, Sri Lanka	180
<i>Christina Semasinghe [et al.]</i>	
Resilience of rural-urban food flows in West Africa	182
<i>Pay Drechsel, Hanna Karg, Richard Kofi Appoh and Edmund Akoto-Danso</i>	

Session 10

Innovations in approaches and tools for inclusive and efficient value chain development

Commercial and inclusive value chains: doing good and doing well	184
<i>Malcolm Harper, John Belt and Rajeev Roy</i>	
Factors influencing successful inclusion of small farmers in modern value chains in ACP countries	188
<i>Andrew Shepherd</i>	
Cross-border trade and women in value chain development	192
<i>Florence Tartanac</i>	
Inclusive and efficient value chains	195
<i>Maximo Torero</i>	
Assessing equity in value chains through a participatory guide to business models that link smallholders to markets: insights from LINK application across diverse value chain settings	196
<i>Mark Lundy [et al.]</i>	
Household asset endowments and implications for inclusive value chains	197
<i>Jason Donovan</i>	
Gender equity in value chain and livelihoods development: innovative approaches and tools	198
<i>Dietmar Stoian</i>	
Innovation for inclusive value-chain development, successes and challenges	199
<i>André Devaux</i>	
Measuring and simulating trust in value chain development	200
<i>Christine Plaisier</i>	

Session 11

Linking global value chains and territories: conceptual insights for understanding and ensuring sustainability at different scales

Agri-chains and territories “zero-deforestation”: what role for the payments for environmental services?	202
<i>Alain Karsenty</i>	
Vulnerability and resilience modelling for sustainable food systems	205
<i>Paolo Prosperi and Thomas Allen</i>	